INVESTIGATION OF COPPER VAPOUR AND ARGON ION LASER MARKINGS ON FILM SUBSTRATE.

By

FOO CHEE WEI

B.Sc. (Campbell University, USA)

Department of Physics

Faculty of Science

University of Malaya

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ABSTRACT

Two laser film marking systems have been designed and constructed. The marking systems are used to study the characteristics of a pulsed and a continuous-wave laser irradiation on motion picture film substrates. The continuous-wave laser used is a 15 W Argon-Ion laser by Spectra Physics. A 3 W sealed-tube copper vapour laser has been constructed as the source for pulsed laser. The laser employs an off-axis unstable resonator to obtain good beam quality and can be operated from 5 to 15 kHz with the maximum output power of 3 W.

The focused laser beams are used to remove the 8-micron thick photographic emulsion layer from 140-micron thick optically clear substrate base without or minimally damaging the underlying substrate. The emulsion removal rate and the resulting etching quality on two types of substrate bases (polyester and triacetate) are investigated.

Pulsed laser irradiated area often exhibits irregularly marked line width. The multipulse photothermal ablation process causes damage to the underlying clear substrate before emulsion removal is complete. The non-selective etching characteristic makes pulsed laser unsuitable for film marking purposes. Analysis of the continuous-wave laser irradiated area using digital imaging system indicates that vaporisation of the emulsion material occurs at a certain energy density threshold. The etching line width is laser power dependent due to thermal diffusion. Continuous-wave laser produces clean and consistent etching with laser-induced photothermal vaporisation mechanism. Triacetate substrate tends to have better marking quality than polyester substrate due to its higher thermal damage threshold. Therefore, higher fluence can be used to ensure cleaner emulsion removal.

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